

ARMY RESEARCH LABORATORY



**Skill Level 10 Navigational Skills:
An Examination of Tactical Unmanned
Vehicle (TUV) Soldier-Marine Capabilities**

David R. Scribner

ARL-TR-1599

MARCH 1998

DTIC QUALITY INSPECTED 2

19980421 141

Excel™ and Windows™ are trademarks of Microsoft Corporation.

The findings in this report are not to be construed as an official Department of the Army position
unless so designated by other authorized documents.

Citation of manufacturer's or trade names does not constitute an official endorsement or approval of
the use thereof.

Destroy this report when it is no longer needed. Do not return it to the originator.

Skill Level 10 Navigational Skills: An Examination of Tactical Unmanned Vehicle (TUV) Soldier-Marine Capabilities

David R. Scribner
Human Research & Engineering Directorate

Abstract

An analysis was performed to identify specific skills required to successfully perform mission planning and navigational tasks for the future tactical unmanned vehicle (TUV) and to determine if U.S. Army soldiers and U.S. marines with a beginning skill level of 10 have those skills. This analysis was performed by the Human Research and Engineering Directorate of the U.S. Army Research Laboratory at the request of the Program Manager Unmanned Ground Vehicles/Systems. Military occupational specialties examined included U.S. Army infantryman (11B), cavalry scout (19D), and the Marine Corps rifleman (0300). System-required mission planning (pre-mission) and navigational functions and tasks were identified. Soldier-marine navigational skills were compared to mission planning and navigational tasks. Results of the analysis show that of 70 navigational skills required by the TUV system, 33 are mismatched because of a higher skills requirement, untrained system-specific skills, or a combination of both.

CONTENTS

PURPOSE	3
BACKGROUND	3
IMPRINT	4
SARGE	5
METHODOLOGY	5
Data Sources	5
Soldier-Marine Navigational Skills Identified	5
Tasks Identified	5
Soldier-Marine Navigational Skills Cross-Walked onto Mission Planning and Navigational Tasks	6
ANALYSIS RESULTS	6
CONCLUSIONS	9
RECOMMENDATIONS	9
BIBLIOGRAPHY	11
APPENDICES	
A. U.S. Army and U.S. Marine Corps Navigational Tasks	13
B. Navigational Task List	19
DISTRIBUTION LIST	25
REPORT DOCUMENTATION PAGE	31
TABLES	
1. Conflicting Tasks and Skills Identified	7
2. Number of Task and Skill Incompatibilities	9

SKILL LEVEL 10 NAVIGATIONAL SKILLS: AN EXAMINATION OF TACTICAL UNMANNED VEHICLE (TUV) SOLDIER-MARINE CAPABILITIES

PURPOSE

The purpose of this document is to identify specific skills required to successfully perform mission planning and navigational tasks for the future tactical unmanned vehicle (TUV) and to determine if U.S. Army soldiers and U.S. marines with a beginning skill level of 10 have those skills. The Program Manager, Unmanned Ground Vehicles/Systems (PMUGV/S) solicited the Human Research and Engineering Directorate (HRED) of the U.S. Army Research Laboratory (ARL) to assist in performing this task.

The desired TUV system will be built to enable operation, in its entirety, by a skill level 10 U.S. Army soldier or a U.S. marine (soldiers-marines). Specifically, the military occupational specialties (MOSs) for these soldiers-marines will be infantryman (11B), cavalry scout (19D), and the Marine Corps rifleman (0300). The source of this issue is the PMUGV Joint Project Office (JPO) TUV outstanding issues database:

Issue No. 1.116: What tasks are required to perform mission preparation after receipt of orders? and

What tasks are required to perform immediate path planning and higher level navigation?

BACKGROUND

The TUV will be the first fielded unmanned system designed for the removal of soldiers-marines from hostile environments. To date, no prior work has addressed the skills required by soldiers-marines to perform teleoperations tasks. The personnel requirement of this future system is that it be readily usable by all soldier-marine skill levels within the MOS fields identified (USMC 0300, U.S. Army 19D, and U.S. Army 11B). The ability to remotely control (teleoperate) this system will depend mainly upon human factors interface design characteristics. Past unmanned ground system failures have been traced to either inefficient sensor design or to poorly designed control display layout. Some anecdotal evidence of this comes from two sources: the Office of the Secretary of Defense (OSD) demonstration (DEMO) I and the surrogate teleoperated vehicle (STV) operational test. During DEMO I, a demonstration of teleoperated systems technology, it was noted that to maintain proper vehicle control, vehicle operators seldom exceeded 5 mph on secondary roads. The STV operational test had two

operators working simultaneously, one for vehicle operation and one for navigation. The STV system had little to no usable situational awareness information, and the operators often could not determine where the vehicle was. (The fiber-optic connection to the vehicle was followed to locate the vehicle.) In addition, the STV tipped over more than once, which was attributed to lack of vehicle orientation cues (pitch and roll). The important issue here is to present navigational information in a cohesive, efficient, and useful manner. Mission success is a combination of well-trained soldiers-marines using well-thought-out equipment.

Before continuing, some explanation of both the improved performance research integration tool (IMPRINT) and the SARGE (not an acronym) mission planner is required to understand this document. IMPRINT is described because of its utility in developing function and task networks, which were needed to establish the tasks required of the operator. The SARGE mission planner is described because of its future incorporation into the TUV system.

IMPRINT

IMPRINT is a WindowsTM-based software application for conducting front end analyses (FEAs) in support of materiel acquisition programs or upgrades. IMPRINT is a multi-dimensioned analysis tool that can be used to conduct a variety of different types of studies. It can be used to assess system (including human) performance during a variety of conditions (e.g., with and without mission-oriented protective posture [MOPP]). Physical and cognitive workload for the system's crew can be estimated. IMPRINT can also be used to assess maintenance policies and procedures (e.g., does adding another shift increase operational availability?). Another use is to assess manpower, personnel, and training requirements for weapon system alternatives being considered.

IMPRINT provides an integrated environment to store and retrieve a variety of data sets that are pertinent to a system. For example, task data, personnel data, equipment data, and force structure data can be combined and integrated using IMPRINT. Additionally, IMPRINT has extensive data libraries and reference data sets that can be pulled directly into an analysis, avoiding data entry and saving user time. Users can also move data easily between IMPRINT and other WindowsTM-based applications. This is the case for this analysis; a complex function and task network was developed in IMPRINT for the purpose of understanding work functions and task breakdown structures. Task information developed in IMPRINT was moved into the ExcelTM spreadsheet environment for this analysis.

SARGE

SARGE is a small all-terrain vehicle that has been fitted with teleoperation-capable hardware and software. The mission-planning capability of the TUV will be adapted from the SARGE. SARGE is a mobile platform that is controlled by an operator at an operator control unit (OCU). This OCU has four basic functions: (a) driving, (b) reconnaissance, (c) navigation, and (d) mission planning. The navigational display lets the operator know where the mobile base unit (MBU) or teleoperated vehicle is in relation to the OCU and friendly or enemy units. The mission-planning display lets the operator plan OCU position, final MBU position, and waypoint placement. Mission planning also includes the use of radio frequency (RF) and line-of-sight (LOS) analysis to plan the optimum MBU route. The SARGE mission planner and navigational displays reside in a separate control-display configuration. This interface exists on a small laptop computer that uses a map display, pull-down menus, and a mouse control in a common personal computer operating system. The SARGE mission planner will be adapted to the future TUV system.

METHODOLOGY

A summary of the methodology used for this analysis is a comparison of tasks required to navigate the TUV and the skills that soldiers-marines have at the skill 10 level. Data sources were sought that described the basic and MOS skills that soldiers-marines have. The appropriate skills were identified in those sources. The tasks from the overall TUV task list were reviewed to identify those tasks relating to navigation. Finally, those tasks were compared to the skills of the soldiers-marines.

Data Sources

Data sources used for this effort are listed in the References section of this report.

Soldier-Marine Navigational Skills Identified

Tasks relating to mission planning and navigation were identified by the author of this report. Soldier-marine common tasks and basic MOS skill requirements are listed in Appendix A.

Tasks Identified

Mission planning (pre-mission) and navigational functions and tasks are listed in Appendix B, Columns 1 through 4. ARL developed a detailed TUV operations task network in

IMPRINT, based on functions of the TUV system. The functions of the TUV system were adapted from a systems engineering functional flow block diagram developed at PMUGV/S.

The IMPRINT model was assembled for assessing soldier-marine workload under various TUV operations and maintenance scenarios. The function and task network for TUV operations and maintenance were developed from collaboration between ARL and PMUGV/S. The task lists have been "cut and pasted" from the IMPRINT task networks.

The mission planning and navigational task lists have been "cleansed" to remove unnecessary or meaningless tasks for the purposes of this analysis. For example, the original task list also includes dummy task nodes and "yes-no" decision points for numerous cognitive choices in the IMPRINT task networks. They were removed for this analysis.

Mission-planning tasks were identified from interviews conducted by PMUGV support personnel with Armored Battalion Scouts (19D), of the 2-69th Armored Battalion at Ft. Benning, Georgia. The content of the interviews concerned the development of a TUV mission plan, based on an operations order (OpOrder) from a battalion-level commander. The mission would include the planning of several legs of a route for the TUV MBU (as listed in task lists) and a vehicle-mounted OCU.

Navigational tasks for driving were formulated by ARL and subsequently approved by PMUGV as a result of an ARL-PMUGV/S effort.

Soldier-Marine Navigational Skills Cross-Walked onto Mission Planning and Navigational Tasks

The tasks affected in the overall function and task list were identified as skill 10 capable (yes, 11, no, 12) in Columns 11 and 12 of Appendix B. Column 13 describes in brief format the nature of the conflict with skill level 10 capabilities. The decision of whether skills were compatible with the tasks was made by the author, using the opinion of a subject matter expert (SME), a Major (Inf) at PMUGV/S who has more than several years of experience in the area of unmanned systems.

ANALYSIS RESULTS

Table 1 is a detailed listing of the nature of conflicting tasks identified for TUV mission planning and navigation.

Table 1
Conflicting Tasks and Skills Identified

Task identified	Soldier-marine MOS affected
<p><i>7.4.3.1.1 Assess Named Area of Interest (NAI) from Operations Order (OpOrder)</i></p> <p>Interpreting an OpOrder is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform this task. We recommend that the assessment of the NAI from the OpOrder be performed by a skill level 20 soldier-marine or that this task be trained to skill level 10 soldiers-marines.</p>	<i>ALL</i>
<i>7.4.3.1.2 Place MBU Icon in Final Reconnaissance, Surveillance, Target Acquisition (RSTA) Point</i>	<i>ALL</i>
<i>7.4.3.1.3 Does MBU LOS and Range Fan Cover the NAI?</i>	<i>ALL</i>
<i>7.4.3.1.6 Reposition MBU to Modify the LOS and Range Fan</i>	<i>ALL</i>
<p>These tasks are untrained tasks which are unique to the SARGE mission planner and are skills unique to the 19D Cavalry Scout at the 30 skill level. We recommend that these tasks either be performed by skill level 30 19D Cavalry Scouts or that soldiers-marines be trained specifically in the use of the SARGE mission planner.</p>	
<p><i>7.4.3.2.1 Is Fiber-optic a Mission Requirement?</i></p> <p>Interpreting an OpOrder is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform this task. We recommend that the assessment of the fiber-optic use from the OpOrder be performed by a skill level 20 soldier-marine or that this task be trained to skill level 10 soldiers-marines.</p>	<i>ALL</i>
<p><i>7.4.3.2.4 Place OCU Icon on OCU Map Display</i></p> <p>The task identified is a specific untrained task which is unique to the SARGE mission planner. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner.</p>	<i>ALL</i>
<i>7.4.3.2.5 Concealment of OCU OK for LOS RF?</i>	<i>ALL</i>
<i>7.4.3.2.6 Is Distance to MBU OK for LOS RF?</i>	<i>ALL</i>
<i>7.4.3.2.7 Is Terrain OK for LOS RF?</i>	<i>ALL</i>
<i>7.4.3.2.8 Is Enemy Situation OK for LOS RF?</i>	<i>ALL</i>
<i>7.4.3.2.9 Is Friendly Situation OK for LOS RF?</i>	<i>ALL</i>
<i>7.4.3.2.14 Is Concealment OK for Fiber-optic?</i>	<i>ALL</i>
<i>7.4.3.2.15 Is Distance to MBU OK for Fiber-optic?</i>	<i>ALL</i>
<i>7.4.3.2.16 Is Terrain OK for Fibre Optic?</i>	<i>ALL</i>
<i>7.4.3.2.17 Is Enemy Situation OK for Fiber-optic?</i>	<i>ALL</i>
<i>7.4.3.2.18 Is Friendly Situation OK for Fiber-optic?</i>	<i>ALL</i>
<p>Interpreting an OpOrder is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform this task. We recommend that the assessment of the OCU concealment, distance to MBU from OCU, terrain, enemy and friendly situations for both LOS RF and fiber-optic operation from the OpOrder be performed by a skill level 20 soldier-marine or that this task be trained to skill level 10 soldiers-marines.</p> <p>Additionally, the tasks identified are specific untrained tasks which are unique to the SARGE mission planner and the operation of the SARGE vehicle. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner and SARGE vehicle operation modes and limitations.</p>	

Table 1 (continued)

7.4.3.3.1	Step MBU back from Present Position	ALL
7.4.3.3.2	Have LOS of Previous MBU Location?	ALL
7.4.3.3.9	Step OCU Back Behind MBU	ALL

The tasks identified are specific untrained tasks which are unique to the SARGE mission planner. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner.

7.4.3.4.1	Coordinate MBU Movement Forward One Leg	ALL
7.4.3.4.2	Coordinate OCU Movement to MBU	ALL

The tasks identified are specific untrained tasks which are unique to the SARGE mission planner. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner.

7.4.3.5.1	Establish Secondary Support Mission to Other Sections	ALL
7.4.3.5.2	Create Alternate Route Plan for Alternate Mission	ALL

Interpreting an OpOrder is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform these tasks. We recommend that the assessment of the mission, enemy, troops, and time available from the OpOrder be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines. Additionally, the task identified is a specific untrained task which is unique to the SARGE mission planner and the operation of the SARGE vehicle. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner and SARGE vehicle operation modes and limitations.

7.4.3.6.2	Evaluate Mission	ALL
7.4.3.6.3	Evaluate Enemy	ALL
7.4.3.6.4	Evaluate Troops	ALL
7.4.3.6.5	Evaluate Time Available	ALL

Interpreting an OpOrder is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 20 skill level should be able to perform these tasks. We recommend that the assessment of the mission, enemy, troops, and time available from the OpOrder be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines.

7.4.3.6.14	Estimate Average Speed Over Route	ALL
------------	-----------------------------------	-----

The task identified is a specific untrained task which is unique to the SARGE mission planner and the operation of the SARGE vehicle. We recommend that all soldiers-marines be trained specifically in the use of the SARGE mission planner and SARGE vehicle operation modes and limitations.

7.4.3.7.1	Collect Coordinated Mission Plans from Sections	ALL
7.4.3.7.2	Send Platoon Mission Plan to Battalion	ALL

Interpreting an OpOrder is a 20-level (E-5 Sergeant) skill. All soldiers-marines at the 11B Infantryman and 19D Cavalry Scout 20 skill level should be able to perform these tasks. We recommend that the assessment of the mission, enemy, troops, and time available from the OpOrder be performed by a skill level 20 soldier-marine or that these tasks be trained to skill level 10 soldiers-marines.

7.5.3.1.4	Navigation Position Correct? (UTM/GPS/Waypoint)	ALL
-----------	---	-----

This task is identified as one that can be performed by all skill level 10 soldiers-marines; however, this task within the TUV operation environment uses navigational aids that will require some training to perform this task in a faster, more efficient manner. We recommend that all operators be trained specifically in the use of the TUV navigational aids, specifically, the heads-up display in the driving view that represents vehicle heading and sensor heading in degrees, the integrated vehicle and sensor icon, and the navigational map screen with the additional integrated vehicle and sensor icon.

CONCLUSIONS

Many tasks are projected to be difficult or impossible for the skill level 10 soldiers-marines of the identified MOSs. There are three reasons: (a) the skill requirement for that generic task was higher than skill level 10, (b) the tasks identified are peculiar to a specific type of system operation (SARGE mission planner), or (c) a combination of reasons (a) and (b).

Of the total list of 70 applicable tasks, there were 33 task and skill incompatibilities. Of these 33, eight were skill level mismatches. These task mismatches were attributed to either the requirement for a skill level 20 for five cases and skill level 30 for three cases. Nine tasks were incompatible because of specific system requirements. Eight tasks were related to the SARGE mission planner and one was attributable to a general TUV task. Sixteen of these tasks were incompatible because of a combination of skill level and system-specific requirements. Table 2 provides these data in tabular form.

Table 2

Number of Task and Skill Incompatibilities

Total navigational tasks:	70
Total task and skill mismatches:	33
Skill mismatches (reason a):	8
Skill Level 20 required:	5
Skill Level 30 required:	3
System-specific skills (reason b):	9
SARGE mission planner specific:	8
TUV system specific	1
Combination of reasons a and b:	16

RECOMMENDATIONS

There are three distinct possibilities for improving these skill mismatches:

1. The future TUV operator interface should be designed to accommodate skill level 10 capabilities for all tasks through the use of sound human factors engineering design or when possible and feasible, to re-allocate certain tasks to be automated, eliminating the skill incompatibility altogether. There are design possibilities to either alleviate the more difficult

tasks or to aid the soldier-marine with automated functions so that the soldier-marine with least experience may still teleoperate and perform the TUV mission successfully.

2. Train skill level 10 soldiers-marines to skill level 20 for those tasks identified with additional system-specific task training. This would require that skill level 10 soldiers-marines be trained in the interpretation and application of an operations order to TUV system operations and capabilities.

3. Alter the skill level 10 requirement for TUV operation to that of skill level 20, with training for system-specific tasks only. The other possibility is changing the criteria for basic TUV operations, to raise the minimum skill level from 10 to 20 or 30, to allow for those navigational skills that are more fully developed in the soldier-marine with more experience.

BIBLIOGRAPHY

- Allender, L., Kelley, T., Archer, S., & Adkins, R. (Winter 1997). IMPRINT: The transition and further development of a soldier-system analysis tool. MANPRINT Quarterly, Vol. V, No. 1.
- Allender, A., Lockett, J., Kelley, T., Salvi, L., Mitchell, D, Headley, D., Promisel, D.B., Richer, C., & Feng, T. (1995). Verification, Validation, and Accreditation of a Soldier-System Modeling Tool, pp. 1219-1223, Proceedings of the Human Factors and Ergonomics Society 39th Annual Meeting, October 9-13, San Diego, CA.
- Commandant, U.S. Army Infantry School (7 May 1993). Map reading and land navigation (Field Manual 21-26). Fort Benning, GA: Author.
- Director, Marine Corps Institute (January 1993). Marine battle skills training (MBST) handbook, Book 2 PVT-LCPL, Individual Combat Basic Tasks. Arlington, VA: Author.
- Headquarters, Department of the Army (October 1985). Soldier's manual of common tasks, skill level 1 (STP 21-1-SMCT). Washington, DC: Author.
- Headquarters, Department of the Army (26 June 1995). Enlisted career management fields and military occupational specialties (AR 611-201). Washington, DC: Author.
- U.S. Marine Corps (5 January 1995). Individual training standards for the infantry (enlisted) occupational field (OCCFLD) (03MCO 1510.35C). Arlington, VA: Author.

APPENDIX A

U.S. ARMY AND U.S. MARINE CORPS NAVIGATIONAL TASKS

U.S. ARMY AND U.S. MARINE CORPS NAVIGATIONAL TASKS

U.S. Army

STP 21-1-SMCT, Soldier's Manual of Common Tasks, Skill Level 1

071-329-1001 - Identify terrain features on a map. Identify major terrain features: hill, ridge, valley, saddle, and depression. Identify minor terrain features: draw, spur, cliff

071-329-1002 - Determine the grid coordinates of a point on a military map using the military grid reference system: Determine the six-digit grid coordinates for a point on a map with a 100 meter tolerance (grid coordinates must contain the correct two-letter 100,000-meter-square identifier). Determine the eight-digit grid coordinates for a point on a map with a 50 meter tolerance (grid coordinates must contain the correct two-letter 100,000-meter-square identifier).

071-329-1003 - Determine a magnetic azimuth using a compass: Determine the correct magnetic azimuth to a designated point, within 3 degrees using the compass-to-cheek method or within 10 degrees using the centerhold method.

071-329-1018 - Determine direction using field-expedient methods: Determine direction using the three field-expedient methods: stick or branch and two stones or a wrist watch, or at night given a clear view of the big dipper.

071-329-1012 - Orient a map to the ground by map-terrain association: Orient a map to North within 30 degrees.

071-329-1005 - Determine a location on the ground by terrain association: Determine the six-digit coordinates of your location to within 100 meters.

071-329-1008 - Measure distance on a map. Determine the straight line distance, in meters, between two points to within 100 meters. Determine the road (curved-line) distance, in meters, between two points to within 200 meters.

071-329-1006 - Navigate from one point on the ground to another point, dismounted: Move on foot to designated points at a rate of 3,000 meters in an hour.

AR 611-201, Jun 1991

Military Occupational Specialty (MOS) 19D, Cavalry Scout

10 - Locates points on a map, distinguishes topographic features, and uses compass

10 - Uses maps, map symbols and overlays

10 - Navigates on ground from point to point

20 - Prepares, files, and distributes maps and overlays.

30 - Evaluates routes, assembly area, and positioning for mounted combat operations.

Military Occupational Specialty (MOS) 11B, Infantryman

10 - Performs land navigation functions by terrain association.

20 - Evaluates terrain and weapon emplacements.

20 - Records operational information on maps.

20 - Reads and interprets maps and aerial photos, reproduces, distributes and files operations, intelligence, administrative and unit training documents, orders and publications.

U.S. Marine Corps Navigation Tasks Identified:

Marine Battle Skills Training (MBST) Handbook, Book 2 PVT-LCPL, Individual Combat Basic Tasks, January 1993

PVTX.18.1 - Perform Basic Map Reading: The Marine must correctly identify the five colors of a map and what each color represents; accurately determine the six-digit grid coordinate of a specified point on a map to within +/- 100 meters; accurately plot a six-digit coordinate on a map to within +/- 100 meters; correctly identify the following natural features on a map: hill, finger, draw, saddle, ridge, and cliff; correctly identify the following man-made features on a map: church, school, building, road, railroad, bridge, and power lines; correctly measure the straight-line distance between two points on a map to within +/- 100 meters (the two points must be at least 4000 meters apart); and correctly measure the curved line distance between two points on a map to within +/- 200 meters (the two points must be at least 4000 meters apart and must be along a road or other curved linear feature).

PVTX.18.2 - Navigate With a Map Using Terrain Association: The Marine must navigate to the two checkpoints using terrain association.

PVTX.18.3 - Navigate With a Map Using a Compass: The Marine must navigate to the four checkpoints, using a map and compass.

CPLX.18.1 - Orient a Map Using Field Expedient Techniques: The Marine must orient a map using a celestial body.

CPLX.18.2 - Locate an Unknown Point Using Resection: The Marine must locate his position using a two-point resection and a six-digit grid coordinate. He must be within 100 meters of his location. The Marine has five minutes to complete this task.

CPLX.18.3 - Locate an Unknown Point By Intersection: The Marine must determine the location of the unknown object by six-digit grid coordinate to within 100 meters within five minutes using two-point intersection.

CPLX.18.4 - Determine Cardinal Directions by Field Expedient Methods: The Marine must determine the four cardinal directions using a celestial body.

CPLX.18.5 - Navigate Around an Obstacle Using the Box Method: The Marine must navigate around an obstacle during the day and night using the box technique.

CPLX.18.6 - Convert Azimuths: The Marine, provided a map, lensatic compass, a protractor, a pencil, a straight edge, and the six-digit grid coordinates of a starting point and destination.

CPLX.18.7 - Navigate by Dead Reckoning: The Marine must navigate to two checkpoints using dead reckoning techniques for land navigation.

CPLX.18.8 - Determine the Magnetic Azimuth to a Distant Point: The Marine must determine the magnetic azimuth to the distant object to within +/- 2 degrees.

CPLX.18.9 - Determine the Elevation of a Point Using a Map: The Marine must determine the elevation of an object or terrain feature to within plus or minus half the contour interval of the map.

SGTX.18.1 - Navigate During the Day Using Intermediate Techniques: The marine must navigate to four of the checkpoints using the GPS, set up the PLRS manpack user unit, manually perform a self-test on the PLRS, determine the time and date using the PLRS, determine your own location using the PLRS, navigate to the four checkpoints using the PLRS.

SGT.18.2 - Navigate During the Night Using Intermediate Techniques: The marine must navigate to four of the checkpoints using the GPS and navigate to the four checkpoints using the PLRS.

***MCO 1510.35C, Individual Training Standards for the Infantry (Enlisted)
Occupational Field (OCCFLD) 03***

Military Occupational Specialty (MOS) 0300, Common Infantryman

Task 0300.4.1 - Determine the location of a point or object by intersection.

Task 0300.4.2 - Determine the location of a point or object by resection.

Task 0300.4.3 - Select routes using a map.

Military Occupational Specialty (MOS) 0311, Rifleman

Task 0311.6.9 - Navigate using a Global Positioning System (GPS).

APPENDIX B
NAVIGATIONAL TASK LIST

Table B-1
Navigational Task List

21

Table B-1
Navigational Task List

FUNCTIONS		TASKS	Skill 10 Capable?		Type of Skill Mismatch	
Top	Mid	Low	Task	Yes	No	
			7.4.3.2.21 RF Position Established	n/a		
			7.4.3.2.22 Fibre Optic Position Established	n/a		
			7.4.3.2.23 Final Teleoperation Point Established	n/a		
			7.4.3.2.12 OCU Fibre Optic Positioning	n/a		
			7.4.3.3.1 Step MBU Back from Present Position		X	SARGE M.P. Specific Tasks
			7.4.3.3.2 Have LOS of Previous OCU Location?		X	SARGE M.P. Specific Tasks
			7.4.3.3.6 Re-position MBU for Proper LOS		X	SARGE M.P. Specific Tasks
			7.4.3.3.9 Step OCU Back Behind MBU		X	SARGE M.P. Specific Tasks
			7.4.3.4.1 Coordinate MBU Movement Forward 1 Leg		X	SARGE M.P. Specific Tasks
			7.4.3.4.2 Coordinate OCU Movement to MBU		X	SARGE M.P. Specific Tasks
			7.4.3.4.5 Add Another Mission Leg	n/a		
			7.4.3.5.1 Establish Secondary Support Mission(s) to other Se		X	Skill 20, SARGE M.P. Specific Tasks
			7.4.3.5.2 Create Alternative Route Plan for Alternative Miss		X	Skill 20, SARGE M.P. Specific Tasks
			7.4.3.6.1 Begin Travel Time Estimate	n/a		
			7.4.3.6.2 Evaluate Mission		X	Skill 20
			7.4.3.6.3 Evaluate Enemy		X	Skill 20
			7.4.3.6.4 Evaluate Troops		X	Skill 20
			7.4.3.6.5 Evaluate Time Available		X	Skill 20
			7.4.3.6.6 Evaluate Terrain	X		
			7.4.3.6.7 Evaluate Natural and Intentional Obstacles	X		
			7.4.3.6.8 Evaluate Terrain Elevations & Slopes	X		
			7.4.3.6.9 Evaluate Possible Roads, Paths & Trails	X		
			7.4.3.6.10 Evaluate Ground Surface (Dirt, Mud, Grass, Snow,	X		
			7.4.3.6.11 Evaluate Foliage (LOS & RF Distances per leg)		X	Skill 20, SARGE M.P. Specific Tasks
			7.4.3.6.12 Terrain Evaluated	n/a		
			7.4.3.6.13 METT Evaluated	n/a		
			7.4.3.6.14 Estimate Average Speed Over Route		X	SARGE M.P. Specific Tasks
			7.4.3.6.15 Travel Time Estimate Complete	n/a		
			7.4.3.7.1 Collect Coordinated Mission Plans from Sections		X	Skill 20
			7.4.3.7.2 Send Platoon Mission Plan to Battalion		X	Skill 20

Table B-1
Navigational Task List

FUNCTIONS		TASKS	Skill 10 Capable?		Type of Skill Mismatch	
Top	Mid	Low	Task	Yes	No	
7.4	Mission Planning			n/a		
7.5	Conduct Mission	****		n/a		
7.6	Post-Mission Activities			n/a		
	7.5.1	Move		n/a		
	7.5.2	System Set-up		n/a		
	7.5.3	Unmanned Operation	****	n/a		
	7.5.4	System Shutdown		n/a		
	7.5.3.1	Teleoperate to AO (and Moving NBC Detection)	****	n/a		
	7.5.3.3	RSTA Mission		n/a		
	7.5.3.4	NBC Survey Mission		n/a		
	7.5.3.5	Teleoperate Back to OCU		n/a		
	7.5.3.6	Drive Forward to MBU		n/a		
	7.5.3.7	Mission Complete (dummy)		n/a		
	7.5.3.1.1	Teleoperate to AO (Moving NBC Detection)		n/a		
	7.5.3.1.2	Navigate		n/a		
	7.5.3.1.3	Visually on Course (terrain navigation)?		X		
	7.5.3.1.6	Yes		n/a		
	7.5.3.1.8	Hold Course		X		
	7.5.3.1.11	dummy3		n/a		
	7.5.3.1.12	dummy4		n/a		
	7.5.3.1.13	Communicate/Report System Status		X		
	7.5.3.1.4	Navigation Position Correct (GPS/UTM/Waypoint)?		X		TUV Operation Specific Task
	7.5.3.1.9	Steer Left		X		
	7.5.3.1.10	Steer Right		X		
	7.5.3.1.7	No		n/a		
	7.5.3.1.5	Immediate Path Obstacle-Free?		X		
	7.5.3.1.11	Stop MBU		X		
	7.5.3.1.12	Reverse Until Obstacle Passable		X		
	7.5.3.1.14	Power Vehicle		X		
	7.5.3.1.15	Too Fast?		X		
	7.3.5.1.17	Yes		n/a		
	7.3.5.1.18	Decrease Throttle		X		
	7.5.3.1.21	dummy2		n/a		
	7.5.3.1.19	Increase Brake		X		

Table B-1
Navigational Task List

FUNCTIONS		TASKS	Skill 10 Capable?		Type of Skill Mismatch	
Top	Mid	Low	Task	Yes	No	
			7.5.3.1.20 Hold Brake	X		
			7.5.3.1.18 No	n/a		
			7.5.3.1.22 Too Slow?	X		
			7.5.3.1.23 Yes	n/a		
			7.5.3.1.25 Increase Throttle	X		
			7.5.3.1.28 dummy1	n/a		
			7.5.3.1.24 No	n/a		
			7.5.3.1.26 Decrease Throttle	X		
			7.5.3.1.27 Hold Throttle	X		
			7.5.3.1.29 Conduct NBC Monitoring	n/a		
			7.5.3.1.30 Detect NBC Contaminants?	n/a		
			7.5.3.1.31 Yes	n/a		
			7.5.3.1.33 Report NBC Information	n/a		
			7.5.3.1.32 No	n/a		
			7.5.3.1.34 Monitor Vehicle Status	X		
			7.5.3.1.35 Monitor Fuel Level	X		
			7.5.3.1.36 Monitor MBU/OCU Battery Levels	X		
			7.5.3.1.37 Monitor Distance Traveled	X		
			7.5.3.1.38 Monitor Date	X		
			7.5.3.1.39 Monitor Time	X		
			7.5.3.1.40 dummy5	n/a		
			7.5.3.1.41 Monitor Vehicle Orientation	X		
			7.5.3.1.42 Monitor Vehicle Pitch Angle	X		
			7.5.3.1.43 Monitor Vehicle Roll Angle	X		
			7.5.3.1.44 Pitch and Roll Angles Acceptable?	X		
			7.5.3.1.45 Yes	n/a		
			7.5.3.1.46 No	n/a		
			7.5.3.1.51 Hold Course	X		
			7.5.3.1.47 Steer Right	X		
			7.5.3.1.48 Steer Left	X		
			7.5.3.1.49 Stop MBU	X		
			7.5.3.1.50 Reverse Until Pitch and Roll is Acceptable	X		
			7.5.3.1.52 dummy7	n/a		
Note: n/a denotes that the task or function is not applicable, regardless of MOS identified,						
an "X" in the "No" column denotes that the task cannot be performed						
an "X" in the "Yes" column denotes that the task can be performed						

<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>	<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>
2	ADMINISTRATOR DEFENSE TECHNICAL INFO CENTER ATTN DTIC DDA 8725 JOHN J KINGMAN RD STE 0944 FT BELVOIR VA 22060-6218	1	DEFENSE LOGISTICS STUDIES INFORMATION EXCHANGE ATTN DIRECTOR DLSIE ATSZ DL BLDG 12500 2401 QUARTERS ROAD FORT LEE VA 23801-1705
1	DIRECTOR US ARMY RESEARCH LABORATORY ATTN AMSRL CS AL TA REC MGMT 2800 POWDER MILL RD ADELPHI MD 20783-1197	1	DEPUTY COMMANDING GENERAL ATTN EXS (Q) MARINE CORPS RD&A COMMAND QUANTICO VA 22134
1	DIRECTOR US ARMY RESEARCH LABORATORY ATTN AMSRL CI LL TECH LIB 2800 POWDER MILL RD ADELPHI MD 207830-1197	1	HEADQUARTERS USATRADOC ATTN ATCD SP FORT MONROE VA 23651
1	DIRECTOR US ARMY RESEARCH LABORATORY ATTN AMSRL CS AL TP TECH PUB BR 2800 POWDER MILL RD ADELPHI MD 20783-1197	1	COMMANDER USATRADOC COMMAND SAFETY OFFICE ATTN ATOS (MR PESSAGNO/MR LYNE) FORT MONROE VA 23651-5000
1	DIRECTORATE FOR MANPRINT ATTN DAPE MR DEPUTY CHIEF OF STAFF PERSONNEL 300 ARMY PENTAGON WASHINGTON DC 20310-0300	1	COMMANDER US ARMY MATERIEL COMMAND ATTN AMCAM 5001 EISENHOWER AVENUE ALEXANDRIA VA 22333-0001
1	DIRECTOR ARMY AUDIOLOGY & SPEECH CENTER WALTER REED ARMY MED CENTER WASHINGTON DC 20307-5001	1	COMMANDER USA OPERATIONAL TEST & EVAL AGENCY ATTN CSTE TSM 4501 FORD AVE ALEXANDRIA VA 22302-1458
1	OUSDA/DDDR&E(R&A)/E&LS PENTAGON ROOM 3D129 WASHINGTON DC 20301-3080	1	USA BIOMEDICAL R&D LABORATORY ATTN LIBRARY FORT DETRICK BUILDING 568 FREDERICK MD 21702-5010
1	CODE 1142PS OFFICE OF NAVAL RESEARCH 800 N QUINCY STREET ARLINGTON VA 22217-5000	1	HQ USAMRDC ATTN SGRD PLC FORT DETRICK MD 21701
1	DR ARTHUR RUBIN NATL INST OF STANDARDS & TECH BUILDING 226 ROOM A313 GAITHERSBURG MD 20899	1	COMMANDER USA AEROMEDICAL RESEARCH LAB ATTN LIBRARY FORT RUCKER AL 36362-5292
1	COMMANDER US ARMY RESEARCH INSTITUTE ATTN PERI ZT (DR E M JOHNSON) 5001 EISENHOWER AVENUE ALEXANDRIA VA 22333-5600	1	US ARMY SAFETY CENTER ATTN CSSC SE FORT RUCKER AL 36362

<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>
1	CHIEF ARMY RESEARCH INSTITUTE AVIATION R&D ACTIVITY ATTN PERI IR FORT RUCKER AL 36362-5354
1	AAMRL/HE WRIGHT PATTERSON AFB OH 45433-6573
1	US ARMY NATICK RD&E CENTER ATTN STRNC YBA NATICK MA 01760-5020
1	US ARMY TROOP SUPPORT CMD NATICK RD&E CENTER ATTN BEHAVIORAL SCI DIV SSD NATICK MA 01760-5020
1	US ARMY TROOP SUPPORT CMD NATICK RD&E CENTER ATTN TECH LIBRARY (STRNC MIL) NATICK MA 01760-5040
1	DR RICHARD JOHNSON HEALTH & PERFORMANCE DIVISION US ARIEM NATICK MA 01760-5007
1	DR JON FALLESEN ARI FIELD UNIT PO BOX 3407 FORT LEAVENWORTH KS 66027-0347
1	COMMANDER USAMC LOGISTICS SUPPORT ACTIVITY ATTN AMXLS AE REDSTONE ARSENAL AL 35898-7466
1	ARI FIELD UNIT FORT KNOX BUILDING 2423 PERI IK FORT KNOX KY 40121-5620
1	STRICOM 12350 RESEARCH PARKWAY ORLANDO FL 32826-3276
1	COMMANDER USA TANK-AUTOMOTIVE R&D CENTER ATTN AMSTA RS/D REES WARREN MI 48090

<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>
1	COMMANDER USA TANK-AUTOMOTIVE R&D CENTER ATTN AMSTA TSL (TECH LIBRARY) WARREN MI 48397-5000
1	INSTITUTE FOR DEFENSE ANALYSES ATTN DR JESSE ORLANSKY 1801 N BEAUREGARD STREET ALEXANDRIA VA 22311
1	GOVT PUBLICATIONS LIBRARY 409 WILSON M UNIVERSITY OF MINNESOTA MINNEAPOLIS MN 55455
1	DR ROBERT KENNEDY ESSEX CORPORATION SUITE 227 1040 WOODCOCK ROAD ORLANDO FL 32803
1	LAWRENCE C PERLMUTER PHD UNIV OF HEALTH SCIENCES THE CHICAGO MEDICAL SCHOOL DEPT OF PSYCHOLOGY 3333 GREEN BAY ROAD NORTH CHICAGO IL 60064
1	DR ARTHUR S KAMLET BELL LABORATORIES 6200 EAST BROAD STREET COLUMBUS OH 43213
1	GENERAL MOTORS CORPORATION NORTH AMERICAN OPERATIONS PORTFOLIO ENGINEERING CENTER HUMAN FACTORS ENGINEERING ATTN MR A J ARNOLD STAFF PROJ ENG ENGINEERING BLDG 30200 MOUND RD BOX 9010 WARREN MI 48090-9010
1	GENERAL DYNAMICS LAND SYSTEMS DIV LIBRARY PO BOX 1901 WARREN MI 48090
1	DR LLOYD A AVANT DEPARTMENT OF PSYCHOLOGY IOWA STATE UNIVERSITY AMES IA 50010
1	DR PAUL R MCCRIGHT INDUSTRIAL ENGINEERING DEPT KANSAS STATE UNIVERSITY MANHATTA KS 66502

<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>	<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>
1	DR MM AYOUB DIRECTOR INST FOR ERGONOMICS RESEARCH TEXAS TECH UNIVERSITY LUBBOCK TX 79409	1	COMMANDANT US ARMY ARMOR SCHOOL ATTN ATSB CDS (MR LIPSCOMB) FT KNOX KY 40121-5215
1	MR WALT TRUSZKOWSKI CODE 522.3 NASA/GODDARD SPACE FLIGHT CENTER GREENBELT MD 20771	1	COMMANDER US ARMY AVIATION CENTER ATTN ATZQ CDM S (MR MCCracken) FT RUCKER AL 36362-5163
1	COMMANDER US ARMY RESEARCH INSTITUTE OF ENVIRONMENTAL MEDICINE NATICK MA 01760-5007	1	COMMANDER US ARMY SIGNAL CTR & FT GORDON ATTN ATZH CDM FT GORDON GA 30905-5090
1	DR DANIEL J POND BATTELLE PNL/K6-66 PO BOX 999 RICHLAND WA 99350	1	DIRECTOR US ARMY AEROFLIGHT DYNAMICS DIR MAIL STOP 239-9 NASA AMES RESEARCH CENTER MOFFETT FIELD CA 94035-1000
1	HQDA (DAPE ZXO) ATTN DR FISCHL WASHINGTON DC 20310-0300	1	COMMANDER MARINE CORPS SYSTEMS COMMAND ATTN CBGT QUANTICO VA 22134-5080
1	HUMAN FACTORS ENG PROGRAM DEPT OF BIOMEDICAL ENGINEERING COLLEGE OF ENGINEERING & COMPUTER SCIENCE WRIGHT STATE UNIVERSITY DAYTON OH 45435	1	DIRECTOR AMC-FIELD ASSIST IN SCIENCE & TECHNOLOGY ATTN AMC-FAST (RICHARD FRANSEEN) FT BELVOIR VA 22060-5606
1	COMMANDER USA MEDICAL R&D COMMAND ATTN SGRD PLC (LTC K FRIEDL) FORT DETRICK MD 21701-5012	1	COMMANDER US ARMY FORCES COMMAND ATTN FCDJ SA BLDG 600 AMC FAST SCIENCE ADVISER FT MCPHERSON GA 30330-6000
1	PEO ARMORED SYS MODERNIZATION US ARMY TANK-AUTOMOTIVE CMD ATTN SFAE ASM S WARREN MI 48397-5000	1	COMMANDER I CORPS AND FORT LEWIS AMC FAST SCIENCE ADVISER ATTN AFZH CSS FORT LEWIS WA 98433-5000
1	GENERAL ELECTRIC COMPANY ARMAMENT SYSTEMS DEPT RM 1309 ATTN HF/MANPRINT R C MCLANE LAKESIDE AVENUE BURLINGTON VT 05401-4985	1	HQ III CORPS & FORT HOOD OFFICE OF THE SCIENCE ADVISER ATTN AFZF CS SA FORT HOOD TX 76544-5056
1	COMMANDER US ARMY MATERIEL COMMAND ATTN AMCDE AQ 5001 EISENHOWER AVENUE ALEXANDRIA VA 22333	1	COMMANDER U.S. ARMY NATL TRAINING CENTER AMC FAST SCIENCE ADVISER ATTN AMXLA SA FORT IRWIN CA 92310

<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>	<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>
1	COMMANDER HQ XVIII ABN CORPS & FORT BRAGG OFFICE OF THE SCI ADV BLDG 1-1621 ATTN AFZA GD FAST FORT BRAGG NC 28307-5000	1	COMMANDER US ARMY JAPAN/IX CORPS UNIT 45005 ATTN APAJ SA AMC FAST SCIENCE ADVISERS APO AP 96343-0054
1	SOUTHCOM WASHINGTON FIELD OFC 1919 SOUTH EADS ST SUITE L09 AMC FAST SCIENCE ADVISER ARLINGTON VA 22202	1	AMC FAST SCIENCE ADVISERS PCS #303 BOX 45 CS-SO APO AP 96204-0045
1	HQ US SPECIAL OPERATIONS CMD AMC FAST SCIENCE ADVISER ATTN SOSD MACDILL AIR FORCE BASE TAMPA FL 33608-0442	1	COMMANDER ALASKAN COMMAND ATTN SCIENCE ADVISOR (MR GRILLS) 6-900 9TH ST STE 110 ELMENDORF AFB ALASKA 99506
1	HQ US ARMY EUROPE AND 7TH ARMY ATTN AEAGX SA OFFICE OF THE SCIENCE ADVISER APO AE 09014	1	DR SEHCHANG HAH DEPT OF BEHAVIORAL SCIENCES & LEADERSHIP BUILDING 601 ROOM 281 US MILITARY ACADEMY WEST POINT NEW YORK 10996-1784
1	COMMANDER HQ 21ST THEATER ARMY AREA CMD AMC FAST SCIENCE ADVISER ATTN AERSA APO AE 09263	1	US ARMY RESEARCH INSTITUTE ATTN PERI IK (DOROTHY L FINLEY) 2423 MORANDE STREET FORT KNOX KY 40121-5620
1	COMMANDER HEADQUARTERS USEUCOM AMC FAST SCIENCE ADVISER UNIT 30400 BOX 138 APO AE 09128	1	DENNIS SCHMIDT HQDA DAMO FDQ 400 ARMY PENTAGON WASHINGTON DC 20310-0460
1	HQ 7TH ARMY TRAINING COMMAND UNIT #28130 AMC FAST SCIENCE ADVISER ATTN AETT SA APO AE 09114	1	US MILITARY ACADEMY MATHEMATICAL SCIENCES CENTER OF EXCELLENCE DEPT OF MATHEMATICAL SCIENCES ATTN MDN A MAJ DON ENGEN THAYER HALL WEST POINT NY 10996-1786
1	COMMANDER HHC SOUTHERN EUROPEAN TASK FORCE ATTN AESE SA BUILDING 98 AMC FAST SCIENCE ADVISER APO AE 09630	1	CECOM SP & TERRESTRIAL COM DIV ATTN AMSEL RD ST MC M H SOICHER FT MONMOUTH NJ 07703-5203
1	COMMANDER US ARMY PACIFIC AMC FAST SCIENCE ADVISER ATTN APSA FT SHAFTER HI 96858-5L00	1	PRIN DPTY FOR TECH GY HDQ US ARMY MATL CMND ATTN AMCDCG T M FISETTE 5001 EISENHOWER AVE ALEXANDRIA VA 22333-0001

NO. OF
COPIES ORGANIZATION

1 DPTY CG FOR RDE HDQ
US ARMY MATL CMND
ATTN AMCRD BG BEAUCHAMP
5001 EISENHOWER AVE
ALEXANDRIA VA 22333-0001

1 DPTY ASST SCY FOR RSRCH & TECH
SARD-TT F MILTON RM 3EA79
THE PENTAGON
WASHINGTON DC 20310-0103

1 OSD
OUSD(A&T)/ODDDR&E(R) J LUPO
THE PENTAGON
WASHINGTON DC 20301-7100

1 CECOM
PM GPS COL S YOUNG
FT MONMOUTH NJ 07703

3 DARPA
L STOTTS
J PENNELLA
B KASPAR
3701 N FAIRFAX DR
ARLINGTON VA 22203-1714

1 ARL HRED AVNC FIELD ELEMENT
ATTN AMSRL HR MJ (R ARMSTRONG)
PO BOX 620716 BLDG 514
FT RUCKER AL 36362-0716

1 ARL HRED MICOM FIELD ELEMENT
ATTN AMSRL HR MO (T COOK)
BUILDING 5400 ROOM C242
REDSTONE ARSENAL AL 35898-7290

1 ARL HRED USAADASCH FLD ELEMENT
ATTN AMSRL HR ME (K REYNOLDS)
ATTN ATSA CD
5800 CARTER ROAD
FORT BLISS TX 79916-3802

1 ARL HRED ARDEC FIELD ELEMENT
ATTN AMSRL HR MG (R SPINE)
BUILDING 333
PICATINNY ARSENAL NJ 07806-5000

1 ARL HRED ARMC FIELD ELEMENT
ATTN AMSRL HR MH (J JOHNSON)
BLDG 1109B 3RD FLOOR
FT KNOX KY 40121-5215

NO. OF
COPIES ORGANIZATION

1 ARL HRED CECOM FIELD ELEMENT
ATTN AMSRL HR ML (J MARTIN)
MYER CENTER RM 3C214
FT MONMOUTH NJ 07703-5630

1 ARL HRED FT BELVOIR FIELD ELEMENT
ATTN AMSRL HR MK (P SCHOOL)
10115 GRIDLEY ROAD SUITE 114
FORT BELVOIR VA 22060-5846

1 ARL HRED FT HOOD FIELD ELEMENT
ATTN AMSRL HR MV (E SMOOTZ)
HQ TEXCOM BLDG 91012 RM 111
FT HOOD TX 76544-5065

2 ARL HRED NATICK FIELD ELEMENT
ATTN AMSRL HR MQ (M FLETCHER)
ATTN SSCNC A (D SEARS)
USASSCOM NRDEC BLDG 3 RM R-140
NATICK MA 01760-5015

1 ARL HRED FT HUACHUCA FLD ELEMENT
ATTN AMSRL HR MY (B KNAPP)
GREELY HALL (BLDG 61801 RM 2631)
FORT HUACHUCA AZ 85613-5000

1 ARL HRED FT LEAVENWORTH FLD ELE
ATTN AMSRL HR MP (D UNGVARSKY)
TPIO ABCS 415 SHERMAN AVE RM 327
FT LEAVENWORTH KS 66027-1344

1 ARL HRED FLW FIELD ELEMENT
ATTN AMSRL HR MZ (A DAVISON)
320 ENGINEER LOOP STE 166
FT LEONARD WOOD MO 65473-8929

1 ARL HRED OPTEC FIELD ELEMENT
ATTN AMSRL HR MR (D HEADLEY)
PARK CENTER IV RM 1450
4501 FORD AVENUE
ALEXANDRIA VA 22302-1458

1 ARL HRED SC&FG FIELD ELEMENT
ATTN AMSRL HR MS (L BUCKALEW)
SIGNAL TOWERS RM 207
FORT GORDON GA 30905-5233

1 ARL HRED STRICOM FIELD ELEMENT
ATTN AMSRL HR MT (A GALBAY)
12350 RESEARCH PARKWAY
ORLANDO FL 32826-3276

<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>	<u>NO. OF COPIES</u>	<u>ORGANIZATION</u>
1	ARL HRED TACOM FIELD ELEMENT ATTN AMSRL HR MU (M SINGAPORE) BLDG 200A 2ND FLOOR WARREN MI 48397-5000	1	CDN ARMY LO TO TECOM ATTN AMSTE CL TECOM HQ RYAN BLDG
1	ARL HRED USAFAS FIELD ELEMENT ATTN AMSRL HR MF (L PIERCE) BLDG 3040 RM 220 FORT SILL OK 73503-5600	1	CHIEF ARL HRED ERDEC FIELD ELEMENT ATTN AMSRL HR MM (R MCMAHON) BLDG 459 APG-AA
1	ARL HRED USAIC FIELD ELEMENT ATTN AMSRL HR MW (E REDDEN) BLDG 4 ROOM 332 FT BENNING GA 31905-5400		
1	ARL HRED USASOC FIELD ELEMENT ATTN AMSRL HR MN (F MALKIN) HQ USASOC BLDG E2929 FORT BRAGG NC 28307-5000		
1	US ARMY RSCH DEV STDZN GP-UK ATTN DR MICHAEL H STRUB PSC 802 BOX 15 FPO AE 09499-1500		
	<u>ABERDEEN PROVING GROUND</u>		
2	DIRECTOR US ARMY RESEARCH LABORATORY ATTN AMSRL CI LP (TECH LIB) BLDG 305 APG AA		
1	LIBRARY ARL BLDG 459 APG-AA		
1	ARL SLAD ATTN AMSRL BS (DR JT KLOPCIC) BLDG 328 APG-AA		
1	USMC LIAISON OFFICE ATTN AMST ML RYAN BUILDING APG-AA		
1	USATECOM RYAN BUILDING APG-AA		
1	COMMANDER CHEMICAL BIOLOGICAL AND DEFENSE COMMAND ATTN AMSCB CI APG-EA		

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE March 1998		3. REPORT TYPE AND DATES COVERED Final	
4. TITLE AND SUBTITLE Skill Level 10 Navigational Skills: An Examination of Tactical Unmanned Vehicle (TUV) Soldier-Marine Capabilities				5. FUNDING NUMBERS AMS Code: 622716.H700011 PR: 1L162716AH70 PE: 6.27.16	
6. AUTHOR(S) Scribner, D. R. (ARL)					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Research Laboratory Human Research & Engineering Directorate Aberdeen Proving Ground, MD 21005-5425				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Laboratory Human Research & Engineering Directorate Aberdeen Proving Ground, MD 21005-5425				10. SPONSORING/MONITORING AGENCY REPORT NUMBER ARL-TR-1599	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) An analysis was performed to identify specific skills required to successfully perform mission planning and navigational tasks for the future tactical unmanned vehicle (TUV) and to determine if U.S. Army soldiers and U.S. marines with a beginning skill level of 10 have those skills. This analysis was performed by the Human Research and Engineering Directorate of the U.S. Army Research Laboratory at the request of the Program Manager Unmanned Ground Vehicles/Systems. Military occupational specialties examined included U.S. Army infantryman (11B), cavalry scout (19D), and the Marine Corps rifleman (0300). System-required mission planning (pre-mission) and navigational functions and tasks were identified. Soldier-marine navigational skills were compared to mission planning and navigational tasks. Results of the analysis show that of 70 navigational skills required by the TUV system, 33 are mismatched because of a higher skills requirement, untrained system-specific skills, or a combination of both.					
14. SUBJECT TERMS robotics task analysis unmanned vehicle skills UGVs				15. NUMBER OF PAGES 35	
				16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified		20. LIMITATION OF ABSTRACT	